To Be Determined Not Applicable

Tobacco Equilibration

Quality Engineering

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A. Objective and Applicability

1. The objective of the equilibration process is to bring tobacco or cigarettes into a stable state with the temperature and moisture content of a controlled air system. The equilibration process is designed to bring different samples of similar tobacco or cigarette types to approximately the same OV so that variations in test results caused by OV and temperature are minimized.

2. Persons performing this procedure must be properly trained in accordance with Tobacco Equilibration Job Procedures for the applicable facility.

3. This procedure applies to those facilities that use PMUSA standards of 75°F (23.9°C) and 60% relative humidity (RH) for filler and for F.T.C. equilibration of cigarette and to those facilities that use ISO standards of 22°C (71.6°F) and 60% relative humidity (RH) for cigarette equilibration.

B. Definitions

1. Air Handling Unit - The mechanical components (i.e., blower, motor, duct work) of a heating and air conditioning system that moves and distributes air.

2. Borgwaldt Volume (BV) - A term used to indicate a cylinder volume determined by a Borgwaldt instrument.

3. Corrected Cylinder Volume (CCV) - With some limitations, the cylinder volume that has been corrected by a standard method to an arbitrary oven volatile, cc/g. Sometimes this method is referred to as BCV or BCCV for Borgwaldt values that are corrected to an arbitrary OV.

4. Cylinder Volume (CV) - The volume that a given weight of tobacco occupies at a given pressure and temperature, cc/g.

5. Cubicle - A rectangular metal container fitted with a wire screen bottom that receives tobacco for equilibration. See the Technical Section of Procedure 440-221, Set Up and Maintenance of Tobacco Equilibration Facility, for a description and dimensions of standard and double-size cubicles.

6. Equilibration - The process of subjecting any item, such as tobacco or cigarettes, to an air system of fixed temperature and humidity for the purpose of bringing the moisture in the tobacco or cigarettes and the moisture in the air to a stable state. This process is designed to bring different samples of similar tobacco or cigarette types to approximately the same OV level so that variations in test results caused by different OVs can be minimized or corrected.

7. Equilibration Cabinet - A unit for equilibrating tobacco or cigarette samples before tests are conducted. A cabinet consists of an assembly

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that "racks" a number of trays suitable for holding samples so that conditioned air can be pulled through the tobacco.

8. Equilibration System - Includes the cabinet assembly, air handling unit, room or chamber serving as a plenum for air delivered to the cabinet, and the sensors and controls that maintain the set conditions for the air.

9. Equilibrium - A stable state wherein moisture is absorbed from the air by the tobacco and released by the tobacco to the air at equal rates (i.e., there is no net gain/loss of moisture on the tobacco).

10. Humectant - An ingredient applied to tobacco, usually in the primary, to plasticize the tobacco and/or to aid in moisture retention.

11. Hysteresis - A physical property of some systems, such as tobacco exposed to air, that defines the difference in equilibrated moisture, or OV: 1) depending on whether the tobacco was initially higher or lower in "As Is" OV than the equilibrated value (i.e., the tobacco is dried or moistened by the air to attain equilibration), or 2) depending on whether the relative humidity is not on target but approaches target (60% RH, for example) from the high side (greater than 60% RH) or from the low side (less than 60% RH).

12. Magnehelic (*) Gauge - A diaphragm driven mechanical gauge that is used to measure differential pressures. The gauge used in this procedure is usually scaled from 0 to 2 inches of water column (in. H_2O).

    (*) Magnehelic is a registered trade name of the Dwyer Instruments, Inc.

13. Orifice Assembly - A device for controlling air flow.

14. Oven Volatiles (OV) - Those substances in tobacco that evolve (evaporate) from the tobacco during treatment in a forced draft (convection) oven at 100°C for 3 hours at sea level. Although water normally is the major component that is volatilized from the tobacco, a number of other substances may be lost in relatively small quantities as compared to the water.

15. Plenum - A large chamber used to improve distribution of air flow.

16. Sieve Test - A test designed to determine the particle size distribution of a sample, particularly tobacco. A stack of screens, arranged with the largest screen opening on top and with progressively smaller screen openings downward in the stack, is used. The tobacco sample is placed on the top screen and the assembly of screens is vibrated or oscillated so that the tobacco is finally retained on a screen where the openings are too small for passage.

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17. Tray - With reference to filler cabinets, a tray is a rectangular container that holds cubicles which hold tobacco for conditioning. For the cigarette equilibration, trays are used to hold cigarettes and are placed in the chambers (FTC) or on racks (ISO).

C. Apparatus

1. Equilibration Cabinet for Cut Filler - (R&D Drawing No. 2434-040A) - Typically, 18 trays (R&D Drawing No. 1950-041A) with each tray containing 16 standard size cubicles with wire mesh bottoms.

2. Equilibration Cabinet for Cigarettes (O/C Administrative and Technical Center Drawing No. A-225) - Typically, a "pigeon hole" style cabinet constructed of plastic laminated plywood. A typical unit has 48 "pigeon hole" chambers, with each chamber holding 5 cigarette trays.

D. Sample Collection

1. Obtaining Sample

a. The source and collection techniques for the samples that are placed in the equilibration cabinet are defined in the appropriate test procedure.

E. Calibration

1. See Procedure 440-221, "Set Up and Maintenance of Tobacco Equilibration Facility," for techniques for measuring and maintaining conditions in the equilibration area. Proper air flows through the cabinets and control of the temperature and relative humidity must be maintained before, during, and after tobacco or cigarettes are placed in the cabinets for equilibration.

F. Testing Procedure

1. Filler Equilibration

a. Before the filler equilibration cabinet is loaded with tobacco samples, the following criteria must be met:

(1) Air velocity for each shelf of the cabinet, as measured with the digital anemometer (see Figure 1) within the previous two years, must be within specifications (see Procedure 440-221, Set Up and Maintenance of Tobacco Equilibration Facility). This information is available in the facility log book. If the log book cannot be located or if the latest readings indicate that one or more of the shelves are outside of air velocity specifications, inform the area supervisor.

(2) Temperature and relative humidity, as measured with the Rotronic instrument (see Figure 2) within the previous 24 hours, must be within specifications (see Procedure 440-221,

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Set Up and Maintenance of Tobacco Equilibration Facility). This information is available in the log book that contains a record of daily readings/adjustments performed by Maintenance and/or Building Administration personnel. If the log book cannot be located or if the latest readings indicate that the conditions are outside of specification, inform the area supervisor.

(3) The Magnehelic (*) gauge (see Figure 3) must read 1.0 ± 0.1 inches of water. If a pressure drop reading of less than 0.9 inches of water is indicated on the gauge, then the blower, as configured, may not be capable of providing proper air flow without excessive variation due to sample types, tray loading, etc. Also, the air filter(s) could be very dirty causing the blower to expend part of its capability overcoming the excessive pressure drop of the filter(s). Maintenance personnel must be contacted to investigate the problem.

A pressure drop of greater than 1.1 inches of water is acceptable; however, it could be an indication of an oversized, or improperly operated, fan/motor or that the orifice openings are too small or partially blocked. If the Magnehelic (*) gauge reading changes without apparent reason, maintenance personnel must check the system and velocity measurements must be conducted to ensure that the air flow has not changed.

b. Inspect the cubicles, trays, and the plenum underneath the trays for excessive buildup of filler, gum, or dust. Remove any buildup of filler and dust with a vacuum cleaner. Gum deposits on the 100-mesh wire ~~of filler and dust locations~~ bottoms of the cubicles can be removed by washing them in warm, soapy water followed by a clean water rinse. The cubicles must be dried before use.

(1) When using a vacuum cleaner, inspect the power cord on the unit for frayed or damaged wires and broken plugs. Have defective wires or plugs replaced or repaired by qualified personnel.

Check the power supply requirements against the name plate on the cleaner. If there is any doubt about the power supply, plugs, or wiring, contact the facility electrician for assistance.

Plug the vacuum cleaner's power cord into the proper receptacle.

(2) The user must wear eye protection while using compressed air to clean the system.

c. Select and remove the proper tray (see Figure 4) from the cabinet for loading. Use proper job safety procedures. A tray must contain only one size of cubicles -- either the standard (6 inches by 5 inches) or double size (12 inches by 5 inches) (see Figure

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5). This is important since tobacco fill height may not be the same for standard or double size cubicles.

Note: Loading of a tray while the tray remains in place in the cabinet is acceptable only if all the cubicles are removed and filled according to Steps F.1e. through F.1h. before the cubicles are replaced in the tray within a short time span (i.e., 15 minutes).

d. Place the tray on a convenient table for loading. If the equilibration room is separated from the normal work area, it is acceptable to bring the tray into the work area for loading, even if the work area is not conditioned to the same strict standard as the equilibration room.

e. Select the proper cubicle (tray) for the samples that are to be equlibrated.

(1) For all sieve samples, or for any CV sample weighing 130 grams or more, use the double size cubicles (12 inches by 5 inches).

Note: The sieve testing procedure specifies 150 ± 20 grams for all filler samples except DET, which is 100 ± 10 grams.

(2) For some (non-DET) CV or any other special samples (non-DET) weighing less than 130 grams, use the standard size cubicles (6 inches by 5 inches). For DET samples of less than 90 grams, use the standard size cubicle.

f. Filler samples, generally collected in the primary area, that are to be tested for sieve or cylinder volume must be transported in rigid polyethylene containers to the equilibration facility.

g. If cigarettes are ripped to obtain filler for equilibration, the paper and filters must be separated from the filler before the filler is equilibrated.

h. To load a tray, remove appropriate size cubicles, one at a time, from the tray and carefully pour the contents of the rigid polyethylene container into the cubicle. Care must be taken to transfer all of the contents of the container into the cubicle with minimal loss or degradation of the sample.

i. Level the sample in the cubicle by gently spreading the sample with the hands.

j. Place a slip of paper that contains sample identification information between the metal wall of the cubicle and the tobacco sample. The identification tag must contain sample number (if used), sample description (especially if sample number not used), shelf number, date, and the time the sample was placed in

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the equilibration cabinet (see Appendix I for a suggested identification tag).

Caution: The identification tag must not cover the top of the tobacco or in any way interfere with the flow of air downward through the sample while in the equilibration cabinet.

k. After filling all the cubicles in a tray with samples, transport the tray back to the cabinet and place it in the appropriate shelf. (See Appendix II for a suggested labeling system to identify the shelf position.) This is best done using a laboratory cart, especially if the equilibration room is separated from the test/work area. Proper job safety procedures should be followed when lifting and transporting the tray.

If there are fewer samples than cubicles in a tray, "dummy" samples of a similar tobacco type must be placed in the remaining cubicles in the tray so that all cubicles are filled to about the same depth.

l. A canned filler monitor for OV must be placed in one of the trays each operating day. Canned cigarette filler monitors may be placed in one of the cubicles. If a cigarette monitor is used, the cigarette paper and filter must be removed and only the cigarette filler placed in the cubicle for equilibration. The height of the ripped cigarette filler in the cubicle must be approximately the same as for the samples.

m. Equilibration is assumed to begin only when either a fully loaded tray is placed on the shelf or when all the fully loaded cubicles are replaced in a tray in the cabinet. Starting time on the sample identification tag(s) must indicate when one of the preceding conditions has been achieved.

n. Equilibration time in the cabinet must be held to 24 ± 2 hours for all samples. After removal from the cabinet, a sample can be stored "without bagging" in the conditioned area for up to an additional 2 hours while testing is being completed. Therefore, the maximum allowable exposure time before testing has been completed on any sample is 28 hours (26 hours in the cabinet plus 2 hours in the humidity controlled room).

If testing cannot be performed within the above time limits, samples must be sealed in rigid polyethylene containers or individual cubicles or trays must be sealed in polyethylene bags and stored in the conditioned area until the testing can be conducted, preferably within 72 hours.

If any of the above criteria are not met, notify the supervisor immediately.

o. If, due to failure in the system, standard temperature, air flow and/or humidity conditions are not maintained during the early

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part of the equilibration period, the samples are considered to be fully equilibrated if the facility is under control at standard conditions for at least the last 6 hours prior to removing the sample from the cabinet and providing that the conditions under step F.11. are met. To state the above in another manner, the facility conditions can be at other than standard conditions for a maximum of the first 20 hours of an equilibration period, providing standard conditions are maintained for the final 6 hours (total exposure of 26 hours) that the sample is held in the cabinet.

p. If a system failure results in the loss of standard conditions during the early part of the equilibration period and it is apparent that standard conditions will not be obtained in less than 20 hours, the samples must be removed from the shelves and sealed in plastic. Individual samples can be stored in rigid polyethylene containers or individual cubicles or complete trays can be inserted into polyethylene bags and stored until the system is under control.

q. After standard equilibration conditions are resumed, the samples can be removed from the polyethylene containers and returned to the equilibration cabinet.

Note: Total cabinet equilibration time for the samples [sum of the exposures for the first and second or more times in the cabinet] must adhere to the criteria in F.11.

r. For testing, individual cubicles or full trays can be removed from the cabinet.

s. If the equilibrated samples are to be tested in a location that is not controlled to the same criteria as the equilibration area, then one of the following procedures must be followed:

(1) Remove only one cubicle at a time from the standard conditions. Complete the testing on each cubicle before removing the next cubicle.

(2) Seal complete trays or any number of cubicles in polyethylene bags and transport from the equilibration area to the testing area. After removing a cubicle for testing, the bag must be resealed until all samples have been removed and tested.

t. A daily OV test must be performed on the canned monitor filler. As for all other samples, the equilibration criteria outlined in F.11. through F.1p. must be maintained. The use of $\bar{x}$ and R control charts is recommended to monitor the OV results, which reflect temperature and relative humidity conditions in the equilibration cabinet. (Refer to standard handbooks on the use of $\bar{x}$ and R charts.)

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2. F.T.C. Cigarette Equilibration

a. Before the cigarette equilibration cabinet is loaded with cigarettes, the following criteria must be met:

(1) Air velocity for each chamber of the cabinet, as measured with the digital anemometer (see Figure 1) within the previous two years, must be within specifications (see Procedure 440-221, Set Up and Maintenance of Tobacco Equilibration Facility). This information is available in the facility log book. If the log book cannot be located or if the latest readings indicate that one or more of the chambers are outside of air velocity specifications, inform the area supervisor.

(2) Temperature and relative humidity, as measured with the Rotronic instrument (see Figure 3) within the previous 24 hours, must be within specifications (see Procedure 440-221, Set Up and Maintenance of Tobacco Equilibration Facility). This information is available in the log book that contains a record of daily readings/adjustments performed by maintenance and/or Building Administration personnel. If the log book cannot be located or if the latest readings indicate that the conditions ae outside of specifications, inform the area supervisor.

b. Inspect the chambers, trays, and the perforated orifice plate (rear of chamber) for excessive buildup of filler and/or dust. Remove any buildup with a vacuum cleaner.

(1) When using a vacuum cleaner, inspect the power cord on the unit for frayed or damaged wires and broken plugs. Have defective wires or plugs replaced or repaired by qualified personnel.

Check the power supply requirements against the anme plate on the cleaner. If there is any doubt about the power supply, plugs, or wiring, contact the facility electrician for assistance.

Plug the vacuum cleaner's power cord into the proper receptacle.

(2) The user must wear eye protection while using compressed air to clean the system.

c. Select and remove cigarette trays (see Figure 6) from a chamber or chambers of the cabinet for loading.

Note: Loading of a tray while the tray remains in the cabinet is not recommended, since the tray must be partially extended to the

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front of the cabinet for loading. This could result in loss of sample if the tray should fall from the cabinet to the floor.

d. Place the tray(s) on a convenient table for loading. If the equilibration room is separated from the normal work area, it is acceptable to bring the tray(s) into the work area for loading, even if the work area is not conditioned to the same strict standards as the equilibration room.

e. Select one tray for each sample to be equilibrated (only one sample to a tray; however, for very large samples, two or more trays can be used).

(1) After opening the packages, place the loose cigarettes in the tray(s) in two rows oriented so that the ends of the cigarettes face the front of the cabinet. Since the two rows of cigarettes will not completely fill the tray, it is acceptable to fill the void by placing cigarettes at a 90° angle to the two rows. This allows for maximum use of the space.

(2) Cigarettes can be stacked as much as three high in the tray.

(3) If packaged cigarettes are opened and, for some reason, not placed in trays in the cabinet for equilibration, the cigarettes must be stored in polyethylene bags or rigid polyethylene containers until the equilibration procedure is initiated.

f. Label each tray by inserting an identification tag into holders provided on the front of the tray or by placing a slip of paper that contains sample identification information inside the tray. The identification tag (slip of paper) must contain sample number (if used), sample description (especially if sample number is not used), cabinet/chamber number, date, and the time that the sample was placed in the cabinet. (See Appendix III for a suggested identification tag.)

Caution: **The identification tag must not interfere with the flow of air above and below the cigarettes.**

g. After filling a tray, transport the tray to the cabinet and place it in the appropriate chamber and rack position. (See Appendix II for a suggested labeling system to identify chamber positions in a cabinet.)

h. "Dummy" samples are <u>not</u> required for cigarette cabinets.

i. Place canned monitors in the cabinet as required by the test protocol. For example, a canned monitor is required for each set of four test samples for the smoking machine.

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j. Equilibration is assumed to begin only when the tray is placed in a chamber of the cabinet. Starting time (see Appendix III) on the sample identification tag(s) must indicate when this condition is met.

k. Equilibration time in the cabinet must be held to 48 ± 8 hours for all samples. If testing cannot be performed on a sample immediately after removal from the cabinet, then the sample must be sealed in a polyethylene bag or in a rigid polyethylene container and stored in the conditioned area until the testing can be conducted, preferably within 72 hours.

If any of the above criteria are not met, notify the supervisor immediately.

l. If, due to failure of the system, standard temperature, air flow, and/or humidity conditions are not maintained during the early part of the equilibration period, the samples are considered to be fully equilibrated if the facility is under control at standard conditions for at least the last 18 hours prior to removing the samples from the cabinet, and providing that the conditions under step F.2k are met.

m. If a system failure results in the loss of standard conditions during any part of the equilibration period, and it is apparent that standard conditions will not be returned in time to provide 18 hours of equilibration at standard conditions without exceeding the maximum holding time in the cabinet (48 ± 8 hours), the samples must be removed from the cabinet and sealed in polyethylene.

n. After standard equilibration conditions are resumed, the samples can be returned to the equilibration cabinet.

o. If the equilibrated samples are to be tested in a location that is not controlled to the same conditions as the equilibration area, then one of the procedures below must be followed.

(1) Remove only one sample (tray) at a time from the standard conditions. Complete the listing on each sample before removing another sample.

(2) Seal tray(s) in polyethylene bags before they leave the equilibration area.

p. An OV test must be performed on the canned cigarette monitor. The use of $\bar{x}$ and R control charts is recommended to monitor the OV results. (Refer to standard handbooks on the use of $\bar{x}$ and R charts.)

3. ISO Cigarette Equilibration

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a. The ISO equilibration procedure does not use a force draft cabinet to direct air flow over the sample. Instead, racks that hold standard cigarette trays (see Figure 7) are positioned within the equilibration room.

b. Temperature and relative humidity, as measured with the Rotronic instrument (see Figure 2) within the previous 24 hours, must be within specifications [22°C (71.6°F) and 60% R.H.]. This information is available in the log book that contains a record of daily readings/adjustments performed by maintenance and/or Building Administration personnel. If the log book cannot be located or the latest readings indicate that the conditions are outside of specifications, inform the area supervisor.

c. Select one tray for each sample and place the tray on a convenient table for loading. If the equilibration room is separated from the normal work area, it is acceptable to bring the tray(s) into the work area for loading, even if the work area is not conditioned to the same strict standards as the equilibration room.

d. After opening the cigarette package(s), place the loose cigarettes in a tray(s) in any orderly orientation. The cigarettes can be stacked three high in the tray(s).

e. Place the tray(s) containing the loose cigarettes in the racks in the ISO equilibration room.

Caution: If packaged cigarettes are opened and, for some reason, are not placed in the equilibration area, the loose cigarettes must be stored in polyethylene bags or rigid polyethylene containers until the equilibration process is initiated.

f. Label each tray(s) by inserting an identification tag into the front of the tray(s) or by placing a slip of paper that contains sample identification inside of the tray(s). The identification tag (slip of paper) must contain sample number (if used), sample description (especially if sample number is not used), date, and the time that the sample was placed in the equilibration area. (See Appendix III for a suggested identification tag.)

Caution: The identification tag must not interfere with the natural flow of air around the cigarettes.

g. Place canned monitor in trays in the equilibration area as required by the test protocol.

h. Equilibration begins when the tray is placed in the rack in the equilibration area. Starting time on the sample identification tag must indicate when this condition is met.

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i. Equilibration time on the rack in the equilibration area must be held to 72 ± 8 hours for all samples. If testing cannot be performed on a sample immediately after it is removed from the rack, then the sample must be selaed in polyethylene (bag or rigid container) and stored in the conditioned area until testing can be conducted, preferably within 72 hours.

If any of the above conditions are not met, notify the area supervisor immediately.

j. If, due to failure of the system, standard temperature or relative humidity conditions are not maintained during the early part of the equilibration period, the samples are considered to be fully equilibrated if the facility is under control at standard conditions for at least the last 48 hours prior to removing the samples from the area, and providing that the conditions under step F.3i are met.

k. If standard conditions are lost and it is apparent that conditions will not be returned in time to provide 48 hours of equilibration at standard conditions without exceeding the maximum holding time of 72 ± 8 hours, the samples must be removed from the rack and sealed in polyethylene.

l. After standard conditions are resumed, the samples can be returned to the equilibration rack.

m. If the equilibrated samples are to be tested in a location that is not controlled to the same criteria as the equilibration area, then one of the procedures below must be followed.

(1) Remove only one sample (tray) at a time from the standard conditions. Complete the testing on each sample before removing another sample.

(2) Seal trays in polyethylene bags before they leave the equilibration area.

n. An OV test must be performed on the canned cigarette monitor. The use of $\bar{x}$ and R control charts is recommended to monitor the OV results. (Refer to standard handbooks on the use of $\bar{x}$ and R charts.)

G. Calculations

1. No calculations are necessary for this procedure.

H. Technical Information

1. Minimum Conditioning Time in Filler Cabinet

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a. Studies have shown that 5-6 hours conditioning time in a filler conditioning cabinet is sufficient for most samples to reach equilibrium moisture content when a through flow of 25 feet per minute velocity is maintained (see Reference 6). A significant deviation in velocity can result in a change in the time required for equilibration. The target for the air flow through the tobacco sample is 25 feet per minute. Since it is not practical to measure the air flow through the sample, the equivalent air flow of 150 ± 15 feet per minute at the shelf face slot is specified. This variation (± 15 ft/min) allowed at the shelf face equates to air velocities through the tobacco ranging from 22.9 to 27.9 feet per minute.

2. Effect of Temperature and Relative Humidity on OV

a. Close control of the temperature and relative humidity at the cabinet is very important. A change of 2% in RH will result in a change in the measured equilibrium OV of about 1% for most tobacco materials. The use of control samples (monitors) is recommended to detect the effect of short term variations in the room conditions due to controller cycling and to provide a basis for evaluating intentional or unintentional changes in standard blends that might affect the equilibrium OV.

3. Effect of Equilibration Time on Test Results

a. It is important to note that a portion of the more volatile components of casing and/or flavorings may be "swept off" the sample during conditioning. For example, propylene glycol is stripped from tobacco and, in general, the quantity removed is a function of exposure (air velocity, time, temperature). If the air velocity through the tobacco is relatively constant and the room temperature is maintained at standard conditions, then the remaining variable is time. The presence, or loss, of volatiles such as propylene glycol could have an effect on some physical test results such as CV. Also, since much of the "light" volatiles
(If present) are lost during the OV testing procedure, the apparent OV can be affected by the loss of volatiles. Therefore, it is important that equilibration time (exposure) be held relatively constant and consistent for all tobacco samples.

4. Equilibration Uniformity for Filler Cabinet

a. Tests were conducted using uncased E-55 bright tobacco to check the uniformity of sample equilibrium in an 18-tray cabinet (Reference 6). After overnight equilibration, samples were taken randomly from each tray until 5 positions in each tray had been sampled twice. The largest difference observed between tray averages was 0.38 OV units. Overall, of 144 OV samples collected, 95% were within ± 0.30 OV units of the mean. Another test of a

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12-tray cabinet showed 95% of the OV values to be within ± 0.40 OV units.

5. Sample Loading for Filler Cabinet

a. Tests have shown that the pressure drop across trays with cubicles half filled with expanded stem, filler, or expanded tobacco is 0.05 inches of water for an air flow of 25 feet per minute through the tobacco (equivalent to 150 feet per minute as measured at the shelf slot). Since the pressure drop across the orifice assembly is 20 times as large as the pressure drop across the sample (1.0 compared to 0.05 inches of water), sample trays can be placed into or removed from the cabinet without significantly altering the air flow through the shelf or through the other shelves. Also, different loadings and different types of tobacco from shelf to shelf will not significantly alter air flow, since the orifice assembly exerts the overriding pressure drop. It is important that all the cubicles within a tray be loaded uniformly and that no empty cubicles or empty spaces are present in a tray, since the air flow presented to the tray will tend to "short circuit" through the path of least resistance.

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J. Revision History

1. [date] -- Original document prepared by M. G. Christy issued.

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